



CAMAERA

# ASSIMILATION OF E-PROFILE OBSERVATIONS IN IFS-COMPO

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PROGRAMME OF  
THE EUROPEAN UNION



IMPLEMENTED BY



1

Coordinated by





CAMAERA

# WP1, TASK 1.2

- Data pre-processing
- Lidar-ratio of nonspherical dust
- First assimilation experiment – preliminary results



PROGRAMME OF  
THE EUROPEAN UNION



IMPLEMENTED BY



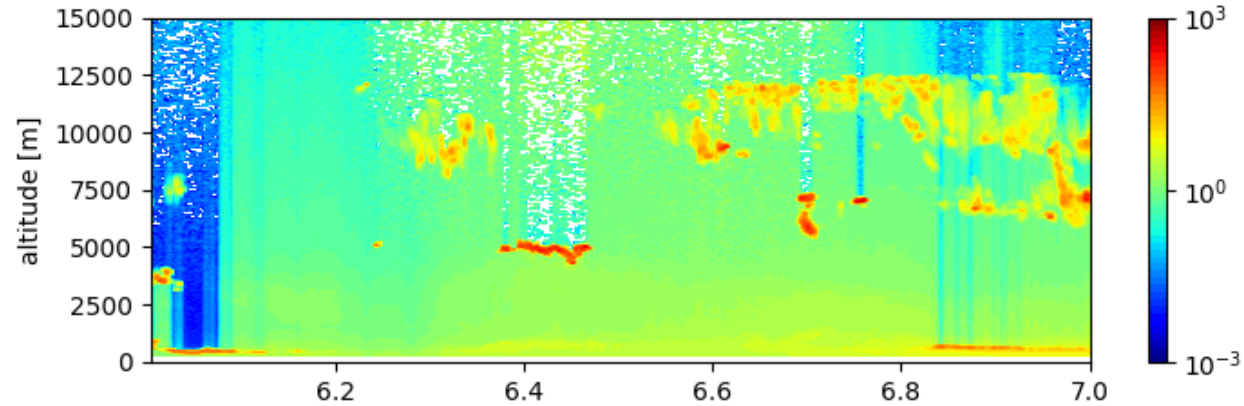
2

Coordinated by



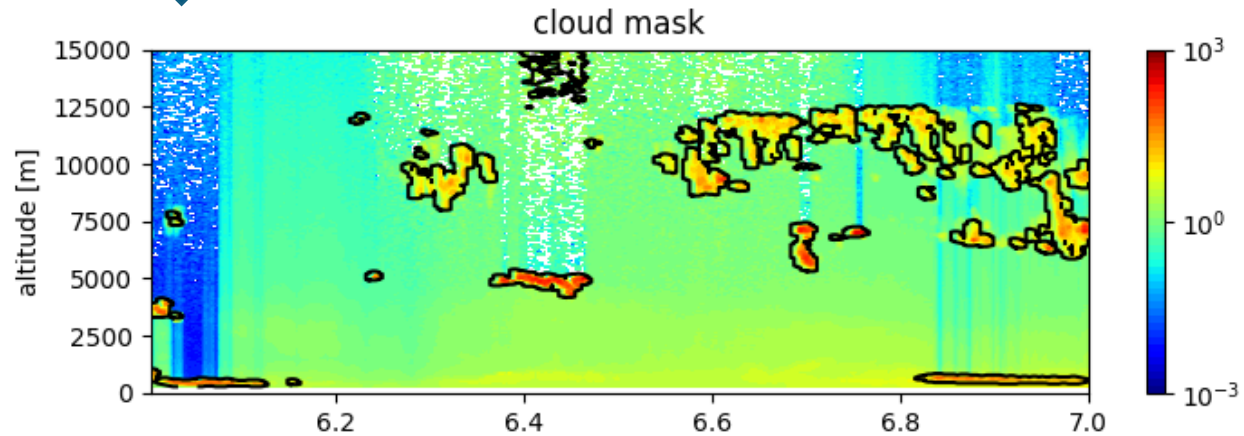


# PRE-PROCESSING OF E-PROFILE DATA



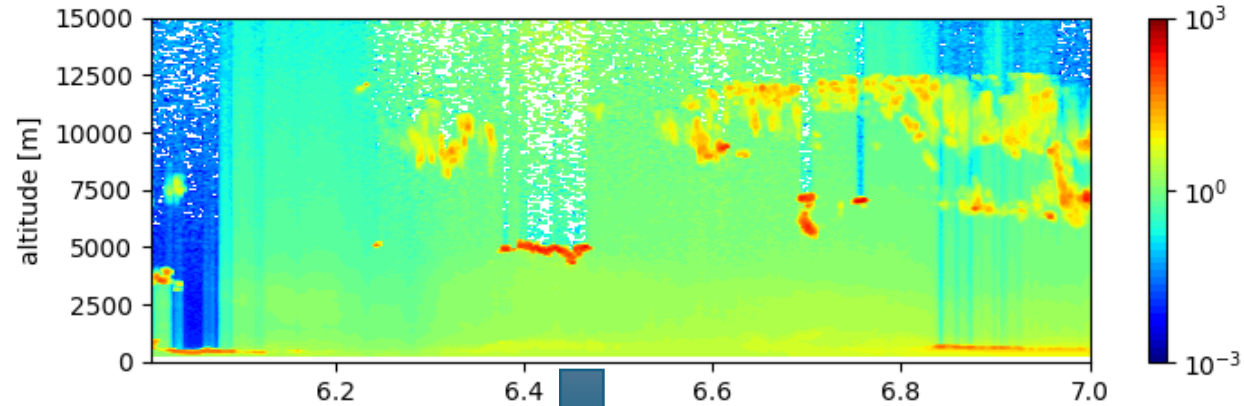
Cloud mask:

$$\text{std}\{\text{obs}(t - 2:t + 2, z - 3:z + 3)\} > \text{threshold} ?$$





# PRE-PROCESSING OF E-PROFILE DATA

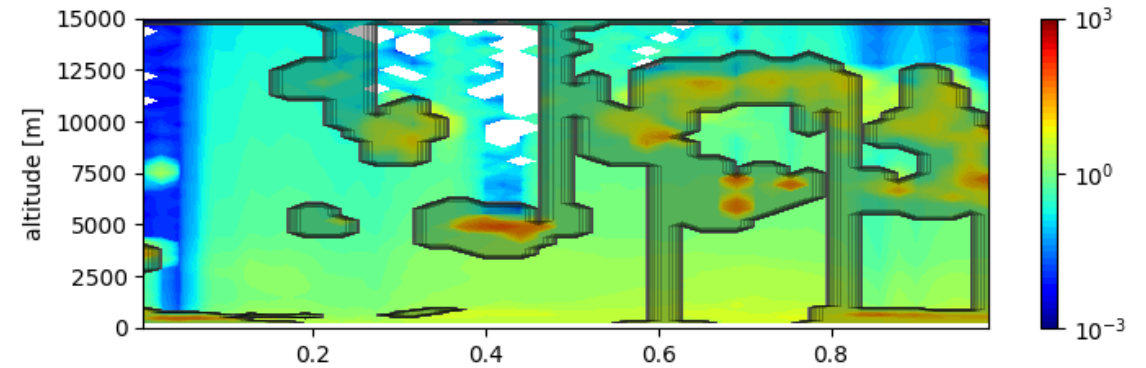
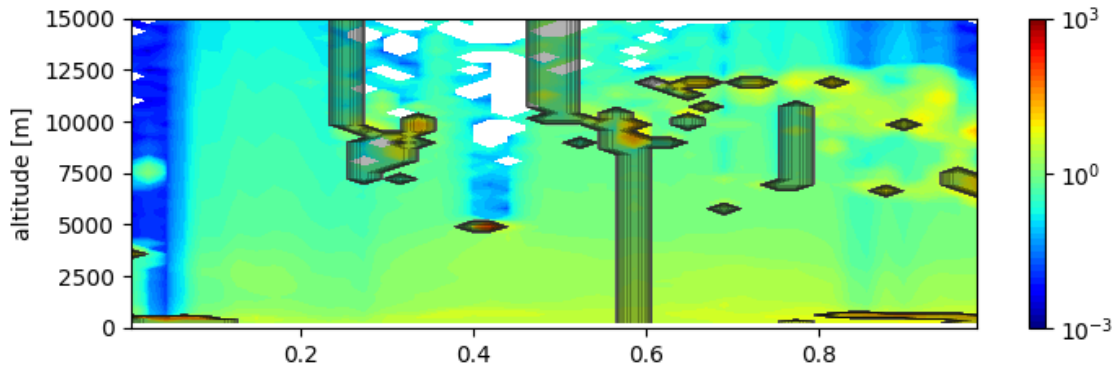


$(\textit{thinning}) * (\textit{masking}) * \textit{obs}$

$(\textit{masking}) * (\textit{thinning}) * \textit{obs}$

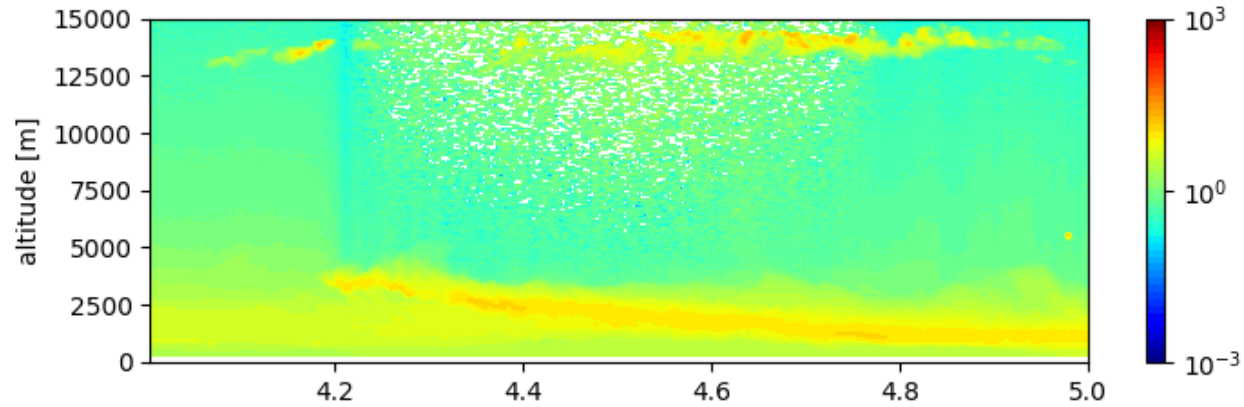


Cloud + rain + fog + noise masks





# PRE-PROCESSING OF E-PROFILE DATA

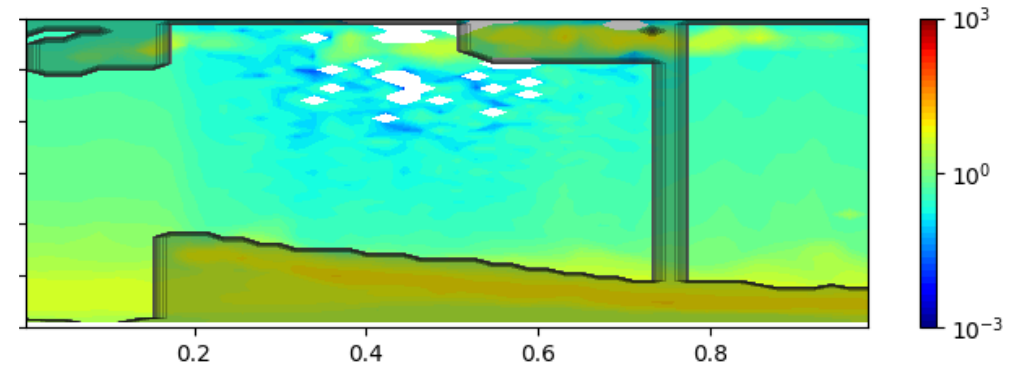
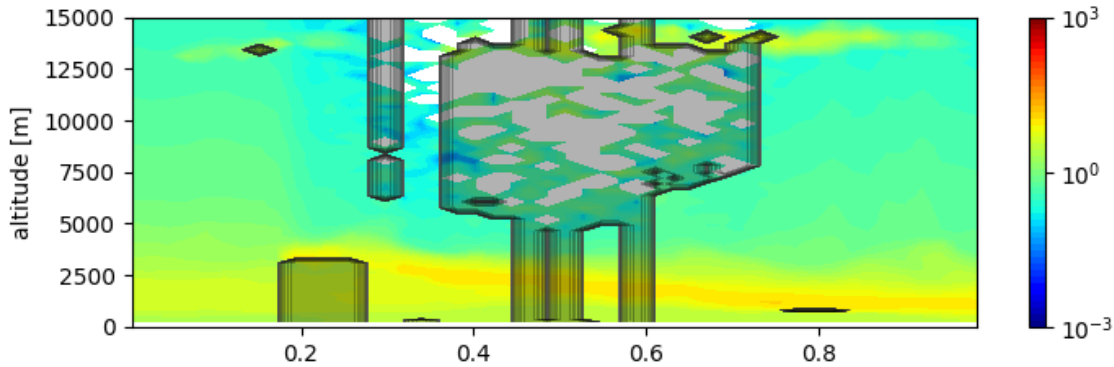


$(\textit{thinning}) * (\textit{masking}) * \textit{obs}$

$(\textit{masking}) * (\textit{thinning}) * \textit{obs}$



Cloud + rain + fog + noise masks





# PRE-PROCESSING OF E-PROFILE DATA

$$(masking\ 2) * (thinning) * (masking\ 1) * obs$$

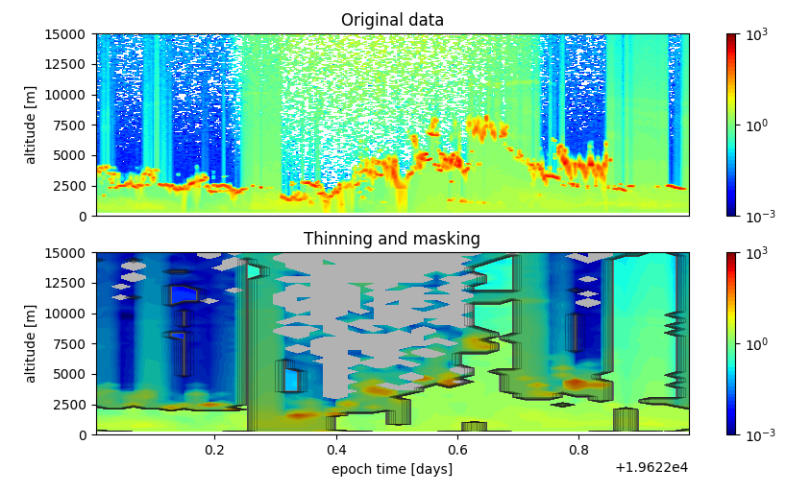
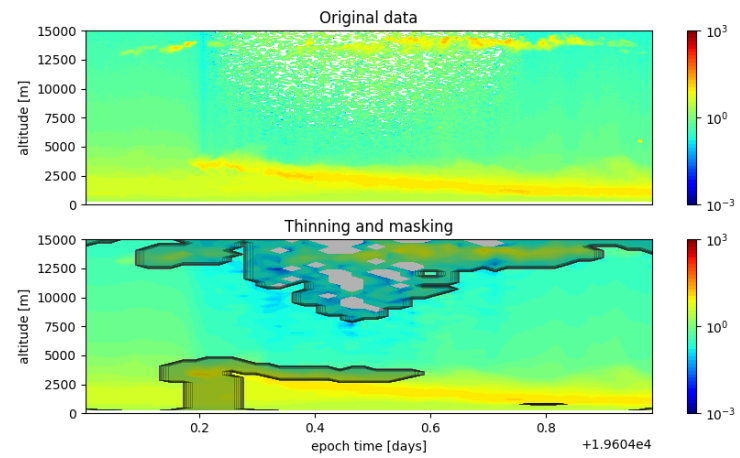
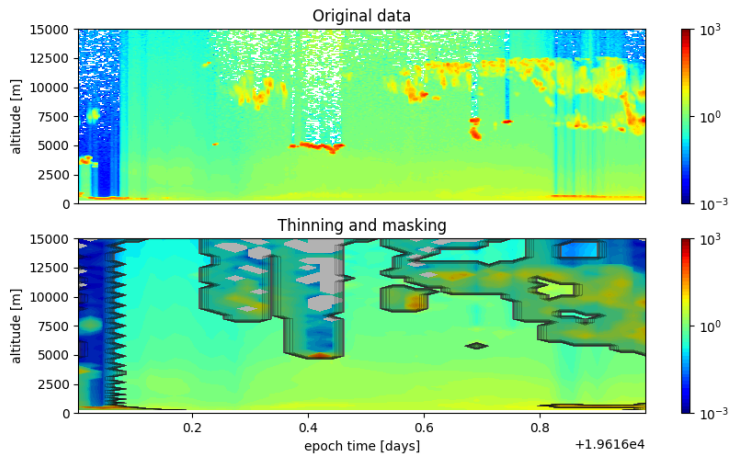
Masking 1: clouds + rain + fog

Thinning: averaging over time and altitude

Masking 2: noise

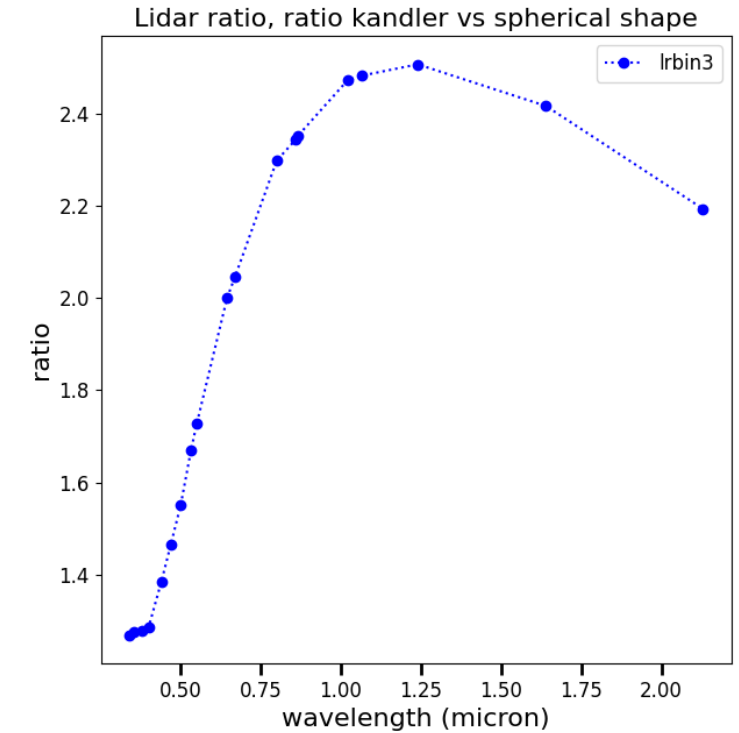
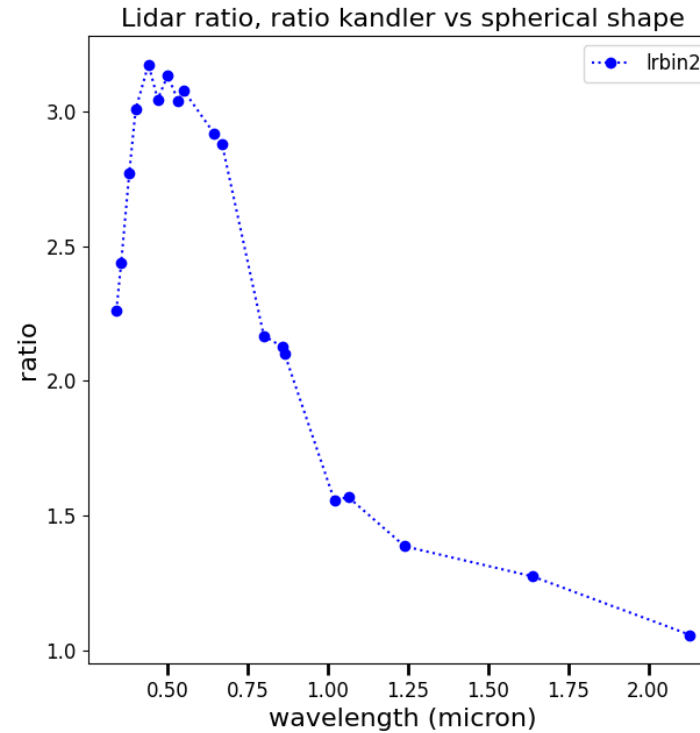
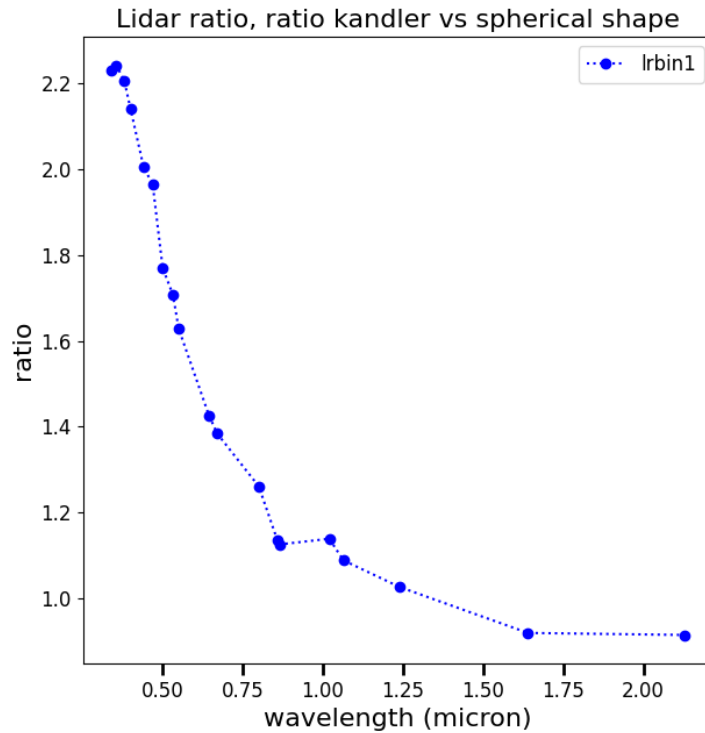


# PRE-PROCESSING OF E-PROFILE DATA





# LIDAR RATIO OF NONSPHERICAL DUST



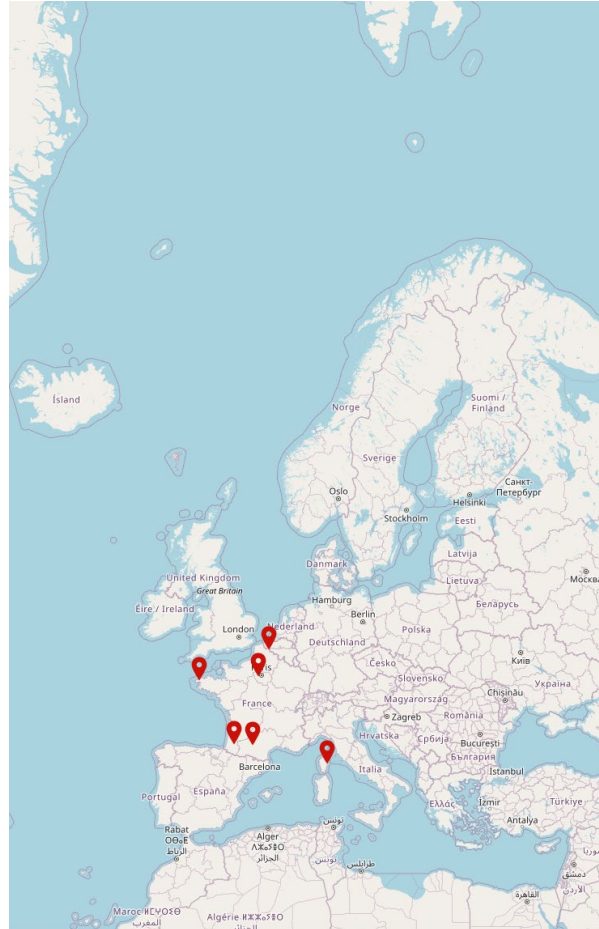




# E-PROFILE STATIONS



CHM15k, 1064 nm



mini-MPL, 532 nm



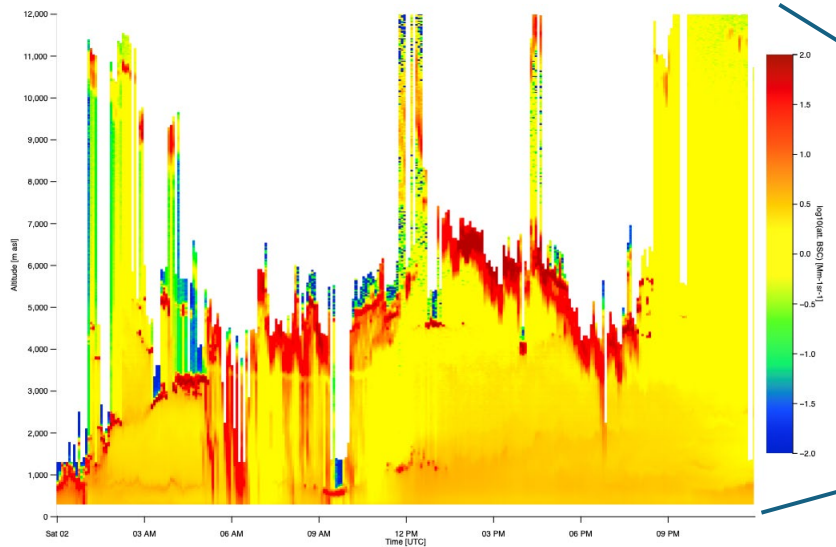
CL31, 910 nm



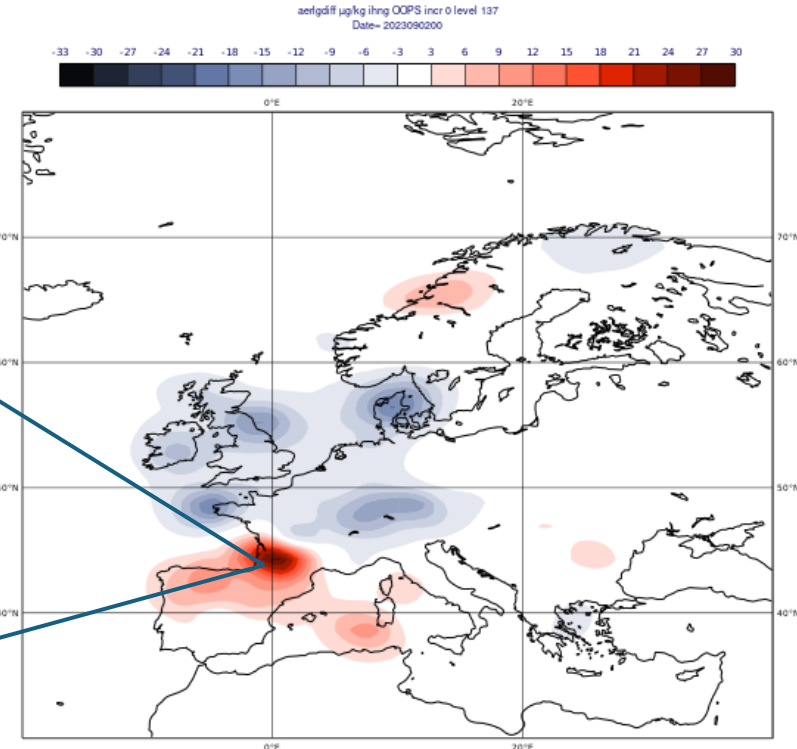
CL51, 910 nm



# E-PROFILE ASSIMILATION EXPERIMENT



Toulouse, 2023-09-02, 532 nm Mini-MPL

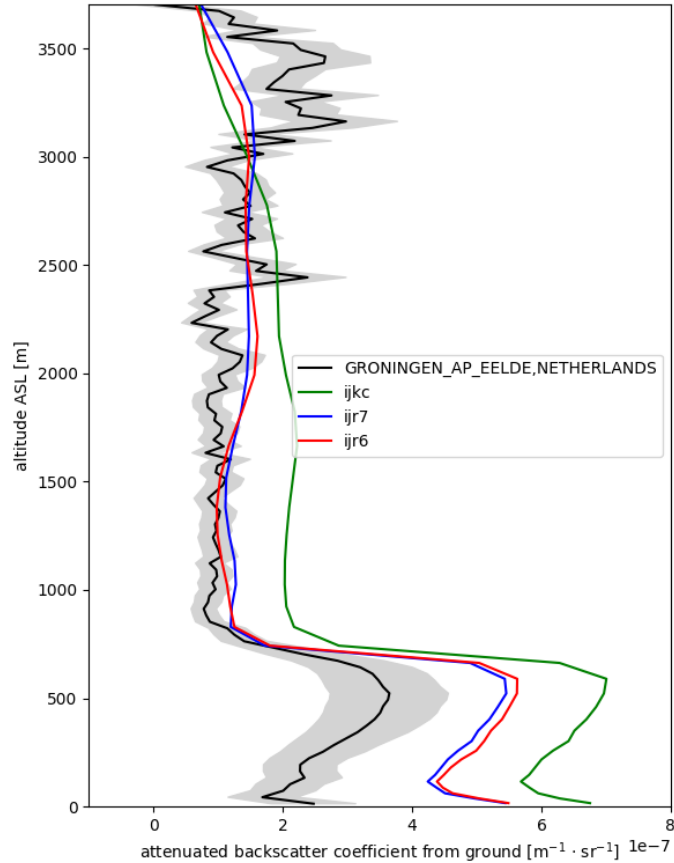


2023-09-02+00:00, d00 analysis cycle,  
Assimilating, 37 stations,  
Total aerosol difference ( $\mu\text{g}/\text{kg}$ ) at ground level

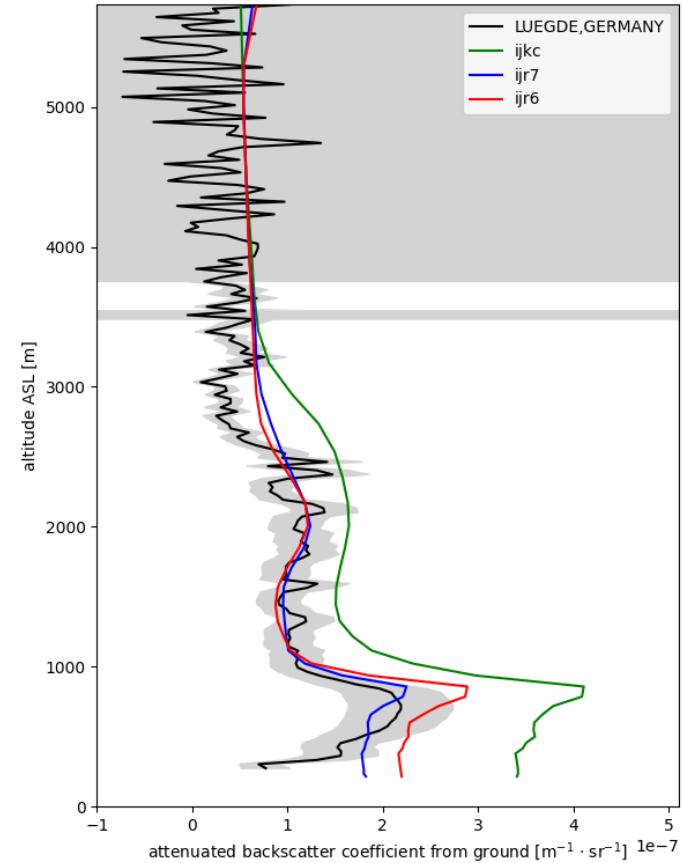


# ASSIMILATED PROFILES

StationID: 0-20000-0-06280 Instrument: CHM15k  $\lambda = 1064.0$  nm  
date: 20230904 time: 150000



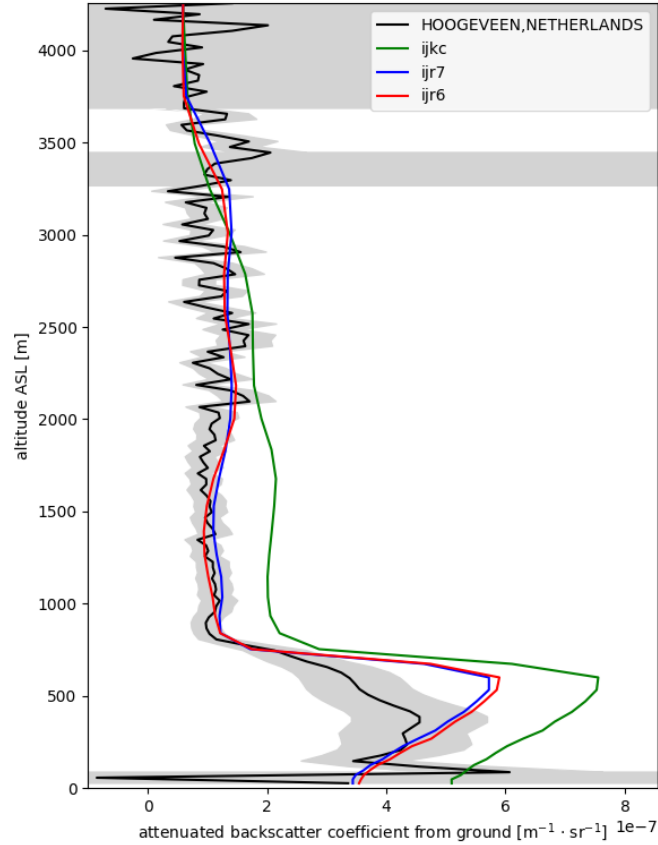
StationID: 0-20000-0-10433 Instrument: CHM15k  $\lambda = 1064.0$  nm  
date: 20230904 time: 150000



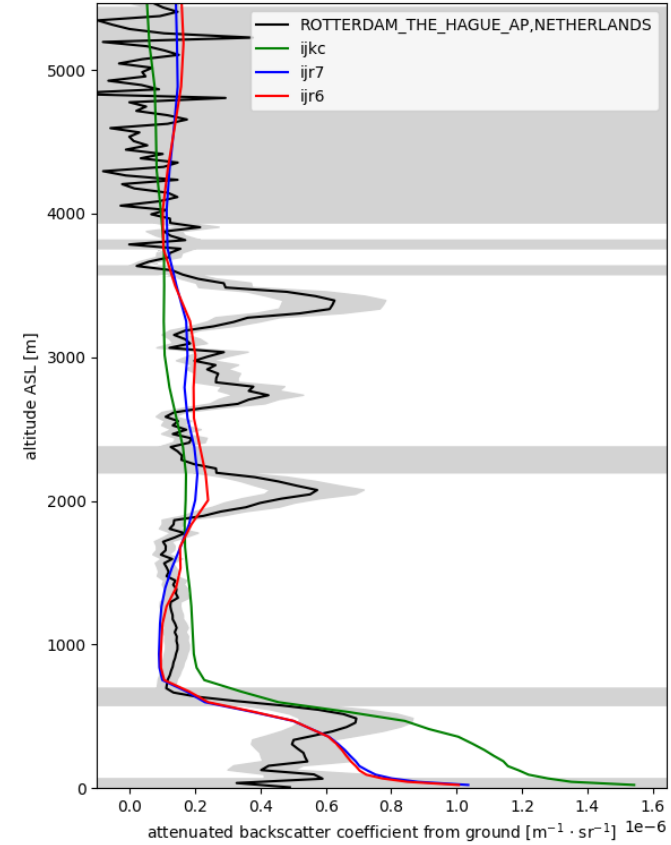


# NOT ASSIMILATED PROFILES

StationID: 0-20000-0-06279 Instrument: CHM15k  $\lambda = 1064.0$  nm  
date: 20230904 time: 150000



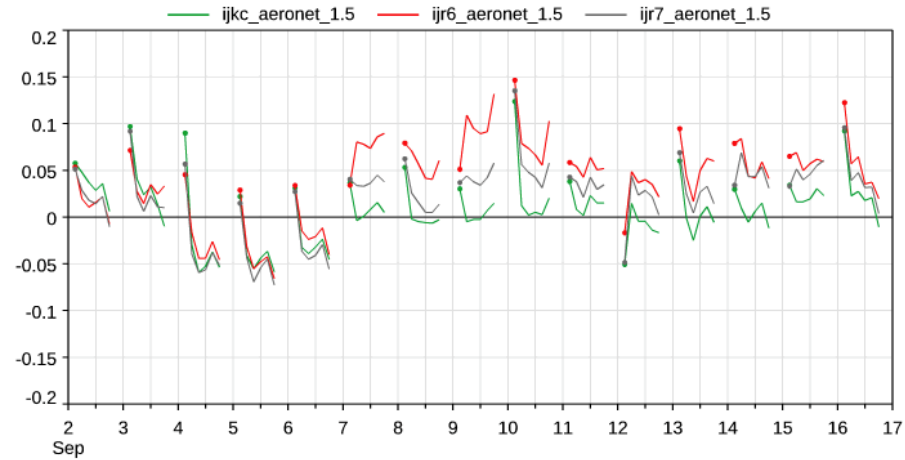
StationID: 0-20000-0-06344 Instrument: CHM15k  $\lambda = 1064.0$  nm  
date: 20230904 time: 150000



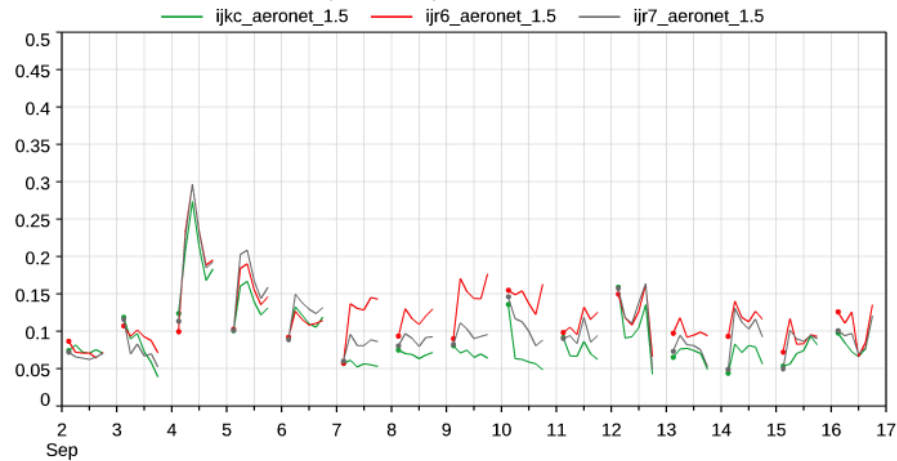


# AOD 500 NM

FC-OBS bias. Model against L1.5 Aeronet AOT at 500nm.  
108 sites in Europe. 2-16 Sep 2023. 00Z, T+3 to 24. Ver0D 12.8.3.



RMS error. Model against L1.5 Aeronet AOT at 500nm.  
108 sites in Europe. 2-16 Sep 2023. 00Z, T+3 to 24. Ver0D 12.8.3.





# MASS MIXING RATIO

PM2.5 (ug/m3) FC-OBS bias. Model versus AirBase.  
440 sites in Europe. 2-14 Sep 2023. 00Z, T+3 to 24. Ver0D 12.8.3.



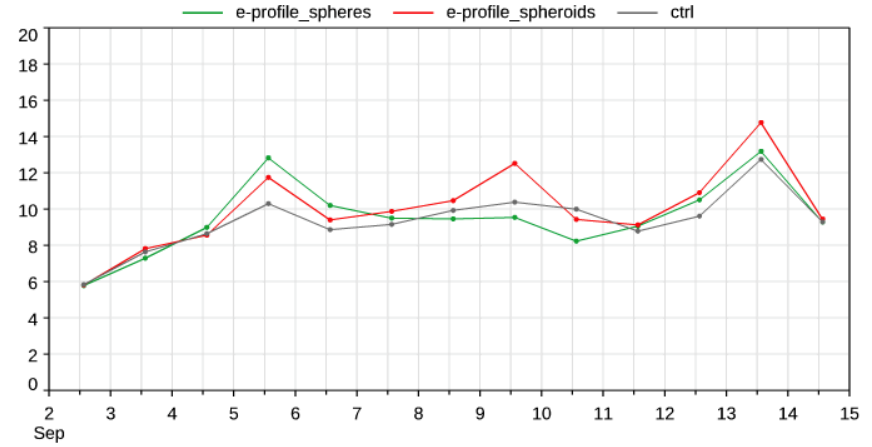
PM10 (ug/m3) FC-OBS bias. Model versus AirBase.  
871 sites in Europe. 2-14 Sep 2023. 00Z, T+3 to 24. Ver0D 12.8.3.



PM2.5 (ug/m3) RMS error. Model versus AirBase.  
440 sites in Europe. 2-14 Sep 2023. 00Z, T+3 to 24. Ver0D 12.8.3.



PM10 (ug/m3) RMS error. Model versus AirBase.  
871 sites in Europe. 2-14 Sep 2023. 00Z, T+3 to 24. Ver0D 12.8.3.





## NEXT STEPS

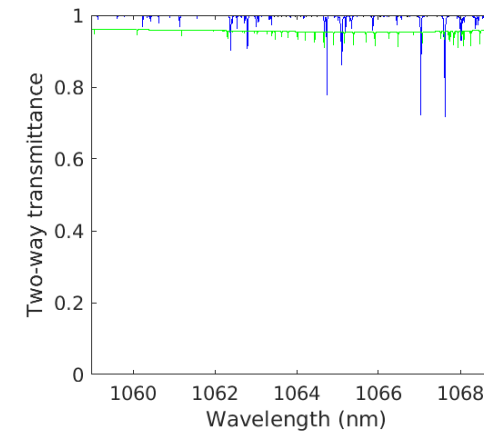
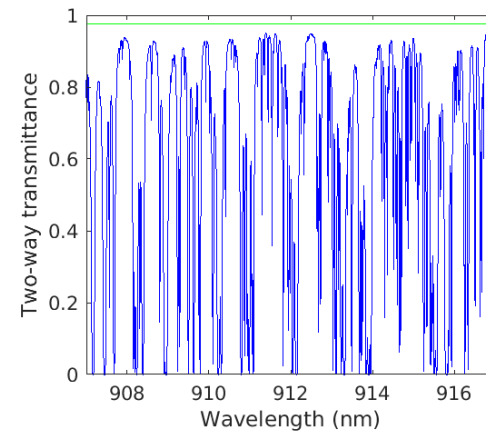
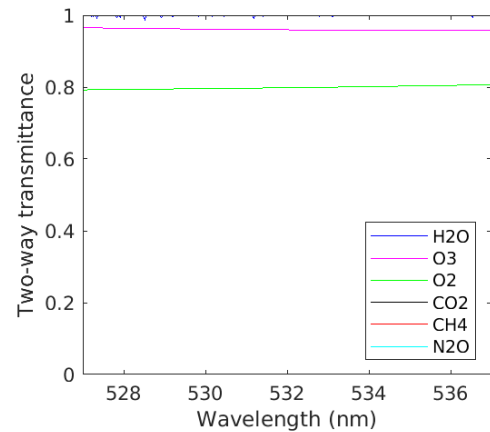
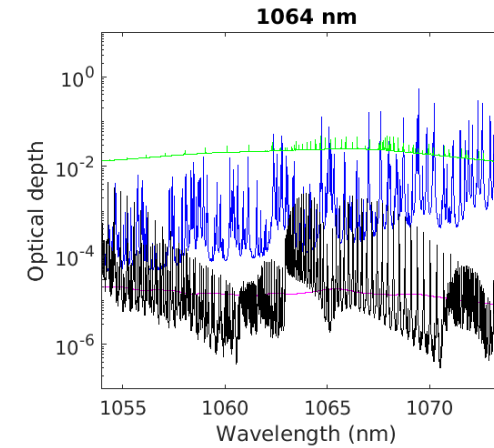
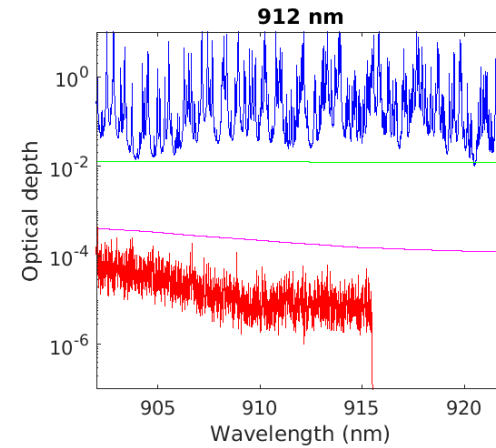
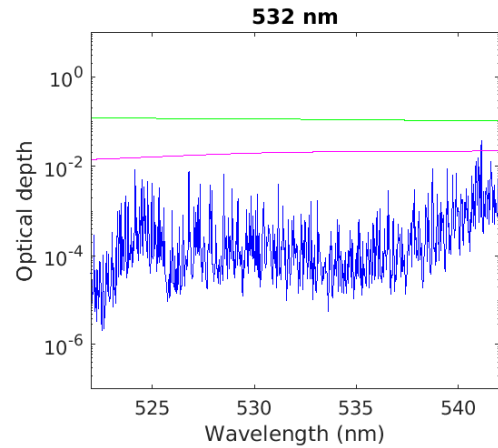
- 910 nm observation operator
- Test assimilation system for ~3 month period during different seasons/events
- Test assimilation of E-profile together with AOD







# PARAMETRISING GAS EXTINCTION AT 910 NM





# PARAMETRISING GAS EXTINCTION AT 910 NM

Malkmus model:

$$\tau_{\text{eff}} = 2C [\text{sqrt}(1 - X K_0/C) - 1]$$

$$C = 0.034$$

$$K_0 = 0.013509 \text{ m}^2/\text{kg}$$

